

REMARKS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 112-118, 120-124, 126-128, and 131-137 are presently active in this case, Claims 1-111 previously canceled; and Claims 112, 114, 118, 120, 121, 124, 126, and 127 having been amended, and Claims 119, 125 and 129-130 canceled and Claims 131-137 added by way of the present amendment.

The present amendment is supplemental to the amendment filed October 20, 2003. The October 20<sup>th</sup> amendment is fully responsive to the July 18, 2003 Official Action, but was not entered because it was considered to raise new issues that require further search and consideration.<sup>1</sup> The October 20<sup>th</sup> amendment is now requested for entry by way of the Request for Continued Examination (RCE) filed herewith. However, further amendments to the claims are made by way of this supplemental amendment in order to clarify the patentable distinctions over the references cited in the July 18, 2003 Official Action, and to vary the scope of patent protection in the present application. The remarks made below relate to the claims changes by this supplemental amendment and are supplemental to the remarks of the October 20, 2003 amendment.

Amended Claims 112, 121 and 126, and new Claim 131 recite a method of forming a barrier metal film formed of a nitride film including tungsten by thermal CVD. The method includes positioning a substrate in a processing vessel, evacuating the processing vessel, and forming a film containing tungsten on one side of the substrate by supplying a processed gas into the processing vessel. Also recited is shutting off the supplying of the process gas into

the processing vessel and completely removing the process gas from the processing vessel by supplying a purging gas into the processing vessel while evacuating the processing vessel.

Nitriding of the film containing tungsten is then performed by supplying  $\text{NH}_3$  gas. In contrast, Chow et al. cited in the July 18, 2003 rejection, does not disclose completely removing a gas from the processing vessel by supplying a purging gas into the vessel while evacuating the processing vessel. Specifically, column 2, line 64- column 3, line 10, of Chow et al. states,

“ . . . after the requisite tungsten deposition time has elapsed, the flow of the gases into the reactor chamber is stopped, and concurrently (1) the reactor chamber is evacuated and (2) the radiant heater is controlled to increase the chamber temperature as indicated by the lowermost curve of Fig. 2 when the reactor pressure reaches about 20mTorr, which for example might be about 10 seconds after the start of evacuation, nitrogen ( $\text{N}_2$ ) is introduced at a rate of about 50-100sccm, while the radiant heater continues to increase the temperature. At about 20 seconds after the start of evacuation, at a chamber pressure of about 200mTorr and a temperature of about 675° C, RF power at about 25-200 watts is provided to subject the wafer 10 to plasma 4 nitridation.”

Thus, as seen in Fig. 2 of Chow et al., the purpose of the introduction of  $\text{N}_2$  is to stabilize the generation of  $\text{N}_2$  plasma, and not to remove the process gas left in the chamber. Chow et al. simply does not teach or suggest completely removing the process gas from the processing vessel by supplying a purging gas into the processing vessel, as now claimed in Claims 112, 121, 126 and 131.

Moreover, the stabilization gas used in Chow et al. is  $\text{N}_2$  gas, as opposed to the  $\text{NH}_3$  gas recited in independent Claims 112, 121, 126, and 131 of the present application. In this regard, Applicants note that  $\text{NH}_3$  gas has a stronger nitridation than  $\text{N}_2$  gas and, thus, provides

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<sup>1</sup> See Advisory Action mailed November 5, 2003.

a better film quality and barrier property. Thus Claims 112, 121, 126 and 131 patentably define over Chow et al.

With regard to Park et al., this reference discloses a method of manufacturing a wiring layer in semiconductor device. Column 2, line 64 - column 3, line 13 of Park et al. discloses that the inside of the contact hole may be first treated with an ECR plasma before forming the WN film. However, Park et al. does not disclose that this pretreatment step completely removes the process gas from the processing vessel by supplying a purging gas into the processing vessel, while evacuating the processing vessel as claimed in Applicant's Claims 112, 121, 126 and 131.

Moreover, column 2, lines 12 - 16 of Park et al. discloses that the WN film is formed by low vapor chemical vapor deposition using  $WF_6$ ,  $NH_3$ , and  $H_2$  as a reacting gas. Thus, the source gas and nitriding gas are simultaneously provided in the process of Park et al. in order to form the WN film. The method of forming the film as recited in Claims 112, 121, 126 and 131 provides a source gas and nitriding gas that are applied separately to form a film. Thus, these claims also patentably define over Park et al. alone or in combination with Chow et al.

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Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. An early and favorable action is therefore respectfully requested.

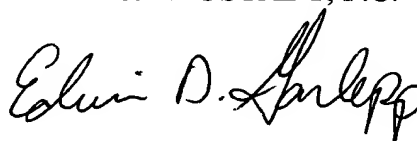
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